Elliptic Flow at SPS and RHIC: From Kinetic Transport to Hydrodynamics *

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We have calculated the impact parameter and transverse momentum dependence of elliptic flow at SPS and RHIC energies using a hydrodynamic model and the low density limit (LDL) of ref. [1].

The elliptic flow data from Au+Au collisions at RHIC [2] show remarkable quantitative agreement with the hydrodynamic model, indicating a large degree of thermalization in the earliest collision stages, well before hadronization. The hydrodynamic model reproduces quantitatively the centrality dependence of v_2 up to impact parameters of about 7 fm and its p_t-dependence up to transverse momenta of about 1.5 GeV/c. Deviations occur only in very peripheral collisions and for particles with $p_t > 1.5\,\mathrm{GeV}/c$; they may be due to a combination of incomplete early thermalization [2] and/or earlier freeze-out in these kinematic regions. The LDL roughly reproduces the shape of the centrality dependence of v_2 at RHIC, but slightly underpredicts the magnitude of the p_t-averaged elliptic flow and fails badly for the shape of its p_t-dependence. It works better for the centrality dependence of v_2 at the SPS, but again cannot describe the observed nearly linear p_t-dependence of proton elliptic flow. The hydrodynamic model gets the shape of all the v_2 distributions at the SPS right, but seems to overpredict the absolute magnitude of v_2; this last statement is, however, uncertain due to the lack of reliable midrapidity data from Pb+Pb collisions at the SPS.

These findings suggest that at RHIC thermalization sets in very early ($\lesssim$1 fm/c), but that it may take longer at the SPS.

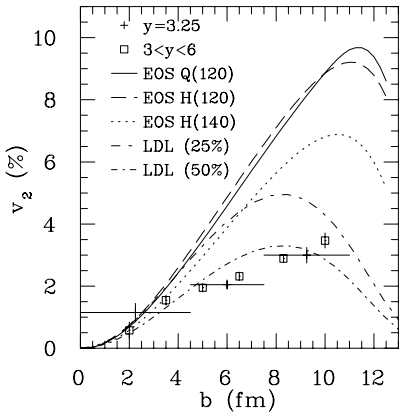

Figure 1: Elliptic flow of pions vs. centrality at SPS compared to data [3].

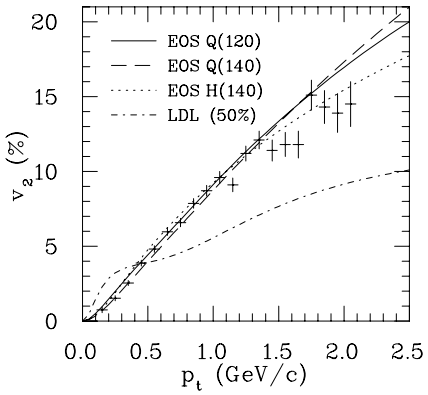

Figure 2: Elliptic flow of charged particles vs. p_t at RHIC compared to data [2].

References

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[3] A. Poskanzer, S. Voloshin *et al.* (NA49 Collaboration), Nucl. Phys. **A661** (1999) 341c.

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